Computer Translation of JP2001-153359

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the glow plug used for diesel-power-plant preheating.

[0002]

[Description of the Prior Art] The thing using the sheath heater by which the above glow plugs enclosed the exoergic coil constituted by resistance exotherm with insulating powder inside the seeds tube which generally consisted of heat-resistant metals is known. And it is used by the screw section formed in this sheath heater in subject metallic ornaments at installation and its peripheral face, attaching in the cylinder crank case of a diesel power plant so that the exoergic section at a head may be located in a combustion chamber. In this case, from the heater temperature-up engine performance, the so-called quick warming whose engine startability is raised and which reaches saturation temperature for a short time is required in many cases in order to be beneficial.

[0003] The glow plug which made **** of coil temperature hard to produce is indicated preparing the control coil which consisted of ingredients which have a forward larger temperature coefficient of resistance than an exoergic coil in a seeds tube at this exoergic coil and a serial, and raising quick warming to JP,59-60125,A there. In the glow plug of this structure, in the early stages of energization, since [that the temperature of a control coil is low] the electric resistance value is small, a comparatively big current flows in an exoergic coil, and rapid temperature up of this is carried out. And if the temperature of an exoergic coil rises, a control coil will be heated by the generation of heat, an electric resistance value will increase, and the energization current value to an exoergic coil will decrease. Thereby, after carrying out rapid temperature up of the temperature-up property of a heater in early stages of energization, it serves as the form where an energization current is controlled by work of a control coil.

[0004] An iron chromium alloy is used as such an exoergic coil, and in order to prevent oxidation of the pure iron and iron which all have a high temperature drag coefficient as a control coil, the iron which performed nickel plating is used.

[0005]

[Problem(s) to be Solved by the Invention] However, although iron has a large temperature coefficient of resistance, it tends to result in an open circuit that rust tends to progress by energization of long duration while it is [that it is very easy to generate ****] inferior to oxidation resistance. The iron which performed nickel plating on the other hand in order to raise oxidation resistance may carry out the lifting alloying of the thermal diffusion between nickel plating and iron while it is more inadequate than that in recent years to a demand of the endurance over a long period of time, and conductivity may fall.

[0006] The object of this invention is in offer of the glow plug equipped with the resistor which is more excellent in both oxidation resistance the endurance over a long period of time and weldability.

[0007]

[Means for Solving the Problem and its Function and Effect] The seeds tube which the head side closed in order to solve the above-mentioned technical problem, and the tubed subject metallic ornaments arranged on the outside where the head side of said seeds tube is made to project, It has two or more resistance-wire coils arranged in the direction of an axis in the seeds tube. The resistance-wire coil This control coil is characterized by consisting of a platinum enveloping layer which covered the core material and this core material including the exoergic coil arranged at the head side of said seeds tube, and the control coil by which a series connection is carried out to this through a joint at the back side of the exoergic coil.

[0008] Platinum does not react with oxygen at an elevated temperature, is an extremely stable metal, and is a metal which is rich in ductility and malleability. Therefore, by having the platinum enveloping layer which covered the core material in a control coil, it has the outstanding oxidation resistance and the endurance over a long period of time can be satisfied from that in recent years. Moreover, as an approach of covering to a core material, it is also possible to carry out wire drawing as a clad plate, and it is hard to produce a crack etc. besides plating or vacuum evaporationo.

[0009] It is desirable to use iron as a core material which performs a platinum coat. It can give the temperature-up property, i.e., the transient-overshoot property which has the peak temperature Tp in early stages of energization, and is saturated below with this peak temperature Tp, of preventing fault temperature up while being able to carry out rapid temperature up of it, since iron is a metal with a high temperature coefficient of resistance. In addition, as a core material, nickel, cobalt iron alloy, or cobalt copper alloy other than iron may be used. However, since the temperature coefficient of resistance of nickel is smaller than iron, rapid temperature up and a transient-overshoot property may become inadequate. And although the temperature coefficient of resistance of a cobalt iron alloy is large, since weldability with an exoergic coil is not enough, depending on the construction material of an exoergic coil, a problem may occur in the endurance of a weld zone. Moreover, although a temperature coefficient of resistance is also large, a cobalt copper alloy is good and workability of weldability improves compared with pure cobalt, wire drawing is difficult and mass production nature is not enough.

[0010] As for this platinum enveloping layer, it is desirable to set it as 0.5 micrometers or more 10 micrometers or less. In less than 0.5 micrometers, without the ability fully demonstrating effectiveness of a coat, oxidation occurs in an internal core material, or internal oxidation progresses further depending on the temperature to be used, peeling may arise in an enveloping layer and oxidation of a core material may progress to it further. Moreover, if it exceeds 10 micrometers, since the amount of the platinum used required for formation of a control coil increases, it may be inferior to profitability. Furthermore, since it energizes also in this platinum layer at the time of energization, the case where material properties, such as a temperature coefficient of resistance of a core material, are unutilizable arises. A platinum enveloping layer is good in it being 1-5 micrometers still more desirably.

[0011] In order to fully employ material properties, such as a temperature coefficient of resistance of a core material, efficiently, when specific resistance in the simple substance of a core material to the specific resistance of platinum is set to x, it is good to carry out the cross section of the core material to the cross section of the platinum enveloping layer in the position of a control coil more than 10x. By setting it as such relation, the transient-overshoot property saturated with temperature lower than the peak temperature in early stages of energization is securable.

[0012] As a wire size of a control coil, it is good to use the following [more than phi0.15mmphi0.5mm]. Less than [phi0.15mm], although endurance improves by the coat of platinum, it is easy to produce the problem on the endurance by a path being too thin. Moreover, if phi0.5mm is exceeded, since the resistance per unit length will become small, in order to demonstrate a control function, the wire rod overall length of a control coil must be lengthened. For this reason, it will be necessary to lengthen a seeds tube, as a result the whole glow plug will be enlarged.

[0013] In addition, it is good by selection of construction material with proper exoergic coil and control coil, a wire size, and coil length RH and to adjust the electric resistance value of an exoergic coil so that the value of the electric resistance ratio (RH/RC) RT in a room temperature may similarly become one or more by setting the electric resistance value of a control coil to RC and the value of the 800-degree C electric resistance ratio (RH/RC) 800 may be set to 0.1-0.4. (RH/RC) When the value of RT becomes less than one, there is a case where it becomes impossible for the quick warming of a heater to fully secure. On the other hand, when the value of 800 (RH/RC) becomes less than 0.1, the energization control by the control coil becomes superfluous, and there is a case where it becomes impossible for an exoergic coil to fully generate heat. Moreover, if 800 (RH/RC) exceeds 0.4, the energization control effectiveness by the control coil will become inadequate, and it will become easy to produce **** of an exoergic coil.

[0014]

[Embodiment of the Invention] Hereafter, it explains based on the example which shows the gestalt of operation of this invention to a drawing. Drawing 1 and drawing 2 are sheath-heater drawings of longitudinal section which are the

general drawing showing an example of the glow plug of this invention, and its important section. This glow plug 1 is equipped with a sheath heater 2 and the subject metallic ornaments 3 arranged on the outside. Two resistance-wire coils 21, i.e., the exoergic coil arranged at the head side, and the control coil 23 the series connection was carried out [the control coil] to the back end by welding etc. are enclosed with the magnesia powder 27 as an insulating material inside the seeds tube 11 with which the head side closed the sheath heater 2.

[0015] The seeds tube 11 has held the exoergic coil 21 and the control coil 23, and a head side projects from the subject metallic ornaments 3, and it forms the lobe. As for this seeds tube 11, the diameter of a control coil 22 is reduced rather than the outer diameter D2 of control-coil hold section 11b held, as for the outer diameter D1 of exoergic coil hold section 11a in which the exoergic coil 21 is held. This outer diameter D1 is set to 3.5-5.0mm (desirably 3.5-4.0mm), the outer diameter D2 is set to 4.0-6.5mm, and the ratios D2/D1 with outer diameters D2 and D1 are formed less than [1.1 or more] in 1.3. Thus, the heat capacity of the control-coil section is enlarged and temperature up can be prevented from progressing quickly by setting up greatly the outer diameter D2 of the control-coil hold section compared with the outer diameter D1 of exoergic coil hold section 11a. Therefore, validity is made to demonstrate more the energization control function to the exoergic coil 21 by the control coil 23, and it becomes easy to give a transient-overshoot property. Moreover, since the outer diameter D1 of exoergic coil hold section 11b is made small, the heat capacity of this part is made small and rapid temperature up is made easy. In addition, although the exoergic coil 21 has flowed with the seeds tube 11 in the head, the peripheral face of the exoergic coil 21 and a control coil 23 and the inner skin of the seeds tube 11 are in the condition that inclusion of the magnesia powder 27 insulated.

[0016] The 20 degrees C electric specific resistance rho 20 sets 80-180micro ohm-cm and 800-degree C electric specific resistance to rho 800, and the exoergic coil 21 is constituted with the iron chromium alloy line or the nickel-chromium alloyed wire by the ingredient and concrete target whose rho800/rho20 are 0.9 to about 1.2. For 0.15-0.4mm and the coil length CL 1, 5-12mm and the coil outer diameter d1 are [the wire size k of the coil / 0.2-0.8mm and the number N of coil turns of 1.5-3.0mm and winding-pitch P] 8-15.

[0017] Moreover, the 20 degrees C electric specific resistance rho 20 sets 12micro ohm-cm and 800-degree C electric specific resistance to rho 800, and the control coil 23 is constituted by the platinum plating low carbon steel wire in which rho800/rho20 have eight or more properties. For 0.15-0.5mm and the coil length CL 2, 10-32mm and the coil outer diameter d1 are [the wire size k of the coil / 0.2-0.8mm and the number N of coil turns of 1.5-3.0mm and winding-pitch P] 25-40. On the other hand, the thickness of platinum plating is 1-5 micrometers.

[0018] Next, the seeds tube 11 has the above-mentioned exoergic coil hold section 11a and control-coil hold section 11b by which it was formed by the twist in the end face side at the major diameter. And the rod-like energization terminal shaft 13 is inserted in the seeds tube 11 from a end face side, and the head is connected to the back end of a control coil 23 by welding etc. On the other hand, male screw section 13a is formed in the back end section of this energization

terminal shaft 13.
[0019] Next, the subject metallic ornaments 3 are formed in tubed [which has the breakthrough 4 of shaft orientations], and after the sheath heater 2 has made the head side of the seeds tube 11 project predetermined length from one opening edge here, they are being inserted and fixed. It faces attaching a glow plug 1 in a diesel power plant, the tool engagement section 9 of the hexagon-head cross-section configuration for making tools, such as a torque wrench, engaged is formed in the peripheral face of these subject metallic ornaments 3, and the screw section 7 for anchoring is formed in the form following this.
[0020] The breakthrough 4 of the subject metallic ornaments 3 is equipped with major diameter 4b located in the opening side in which the seeds tube 11 projects, and narrow diameter portion 4a following this, and control-coil hold section 11b and major diameter 11c formed in the diameter of said are pressed fit in the end face side of the seeds tube 11, and it is being fixed to this narrow diameter portion 4a. On the other hand, spot facing section 3a is formed in opening of the opposite hand of a breakthrough 4, and O ring 15 and insulating bushing (for example, thing made of nylon) 16 made of rubber by which sheathing was carried out to the energization terminal shaft 13 are inserted in here. And the energization terminal shaft 13 is equipped with the ferrule 17 for preventing omission of an insulating bushing 16 at the back side at the pan. While this ferrule 17 is fixed to the energization terminal shaft 13 by caulking section 17a formed in the peripheral face, knurling tool section 13b for heightening caulking bonding strength is formed in the front face on which the energization terminal shaft 13 corresponds. In addition, the nut 19 for fixing the cable for energization to the energization terminal shaft 13 is screwed in male screw section 13a.
[0021] Hereafter, the dimension of each part of the glow plug 1 of drawing 1 and drawing 2 etc. is illustrated concretely.
- Overall-length L1=145mm (exoergic coil 21)
- Construction material : iron chromium alloy (presentation: aluminum=7.5 % of the weight;Cr= 26 % of the weight; Fe= remainder, rho20= 160micro ohm-cm, rho800/rho 20= 1.0).
- Dimension : k= 0.38mm and 1= 8mm [of CLs] d 1= 2.3mm, P= 0.6mm, N= 8. The 20-degree C electric resistance value RH of the whole coil is 0.6ohms.
(Control coil 23)
- Construction material : platinum plating low carbon steel wire (rho20= 12micro ohm-cm, rho800/rho20=8).
- Dimension : the electric resistance value RC in the room temperature of k= 0.28mm, and the 2= 13mm d 1= 2.3mm, P= 0.5mm, whole N= 25 and the whole coil of CLs is 0.2ohms.
[0022] (Seeds tube 11)
- Construction material : SUS310S.
- Dimension : 1= 4.5mm of D, t= 0.72mm, 1= 0.16mm of t/D, CG=0.38mm, 2= 5.0mm [of outer diameters D of the diameter expansion section] L 2= 22mm.
[0023] (Subject metallic ornaments 3)
- Construction material : machine structural carbon steel (S45C).

- Dimension : die-length L4=24mm of die-length L3=8mm of the part (henceforth the body 5) located in a head side rather than the screw section 7, the outer diameter D of 4= 8.2mm of the body 5, and the screw section 7, the outer diameter D of 5= 10mm of the screw section 7.

[0024] Hereafter, an operation of the glow plug 1 of drawing 1 and drawing 2 is explained. A glow plug 1 is attached in the cylinder block of a diesel power plant in the screw section 7 of the subject metallic ornaments 3. Thereby, the point of the seeds tube 11 with which the exoergic coil 21 and the control coil 23 were held is positioned in an engine combustion chamber (or secondary combustion chamber). If an electrical potential difference is impressed to the energization terminal shaft 13 by using a mounted dc-battery as a power source in this condition, it will energize in the path of energization terminal shaft 13 -> control-coil 23 -> exoergic coil 21 -> seeds tube 11 -> subject metallic-ornaments 3 -> (a cylinder crank case is minded and it is touch-down).

[0025] Thereby, in the early stages of energization, since [that the temperature of a control coil 23 is low] the electric resistance value is small, a comparatively big current flows in the exoergic coil 21, and the sheath heater 2 of a glow plug 1 carries out rapid temperature up of this. And if the temperature of the exoergic coil 21 rises, a control coil 23 will be heated by the generation of heat, an electric resistance value will increase, and an energization current value will decrease to the exoergic coil 21. Thereby, after carrying out rapid temperature up of the temperature-up property of a heater in early stages of energization, it becomes the form where an energization current is controlled by work of a control coil and temperature is saturated, henceforth.

[0026] Specifically, difference TP-TS of the peak temperature TP and the after [60 seconds] temperature TS becomes able [50-200 degrees C and the peak temperature TP] to stabilize for it and realize the property the resistance welding time t800 until it reaches 900-1150 degrees C and 800 degrees C excelled [property] in the quick warming for 8 or less seconds.

[0027] Drawing 3 shows the resistance welding time of the conventional glow plug C and the relation of temperature which used the pure iron line for the conventional glow plug B and conventional control coil which used the nickel-plating pure iron line for the glow plug A and control coil of this invention that used the platinum plating pure iron line for the control coil. This trial was performed as follows. First, these glow plugs were held in the room temperature, and the temperature-up characteristic curve (temperature-time amount curve) when energizing in energization electrical-potential-difference 11V was measured. That is, in the lobe of the seeds tube 11, while setting up the measurement section to 8mm in the direction of an axis from the head and investigating beforehand the maximum-temperature location in the measurement section, the thermocouple (Pt/Pt-Rh) was fixed to this location, continuation energization was carried out at the sheath heater 2, time amount change of temperature was measured, and the temperature-up characteristic curve was acquired. This measuring method is based on the approach specified to ISO7578 (1986).

[0028] From drawing 3 which shows this measurement result, it is proved that the

glow plug A of this invention has the function of self-temperature control to the same extent as the conventional glow plug B and the conventional glow plug C.
[0029] Moreover, drawing 4 shows the result of the test of the open-circuit endurance of a glow plug A, a glow plug B, and a glow plug C. The result of having repeated the cycle which connects with the power source of 14V for 300 seconds, energizes, and carries out an energization halt for 60 seconds is shown. Even if it exceeded 10,000 cycle, an open circuit did not arise, but the glow plug A was disconnected in 7000 cycles, and the glow plug B has disconnected the glow plug C in 2000 cycles.
[0030] Drawing 5 shows other examples. In this example, the low resistance coil 20 was infixed in the exoergic coil 21, a control coil 23, and the medium, and both location is detached. With this configuration, the Joule's heat in the exoergic coil 21 has prevented what is directly transmitted to a control coil 23 from the welding point.
[0031] Thereby, with the Joule's heat in the exoergic coil 21, the skin temperature of the point of the seeds tube 11 carries out rapid temperature up, and since delay and current control are delayed, the temperature rise of a control coil 23 can control the exoergic temperature at the time of afterglow, and can improve endurance. Nickel and a nickel chromium alloy line can be used as a low resistance coil 20. Moreover, with this configuration, an ingredient with sufficient weldability can also be used for the both sides of the exoergic coil 21 and a control coil 23.
[0032] Although the platinum plating pure iron line was used for the construction material of a control coil in the above-mentioned example, what vapor-deposited instead of plating may be used. Moreover, the wire rod which carried out the drawing of the clad plate which inserted the pure iron line into the seamless pipe of platinum may be used.

[Translation done.]